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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/036,156	12/26/2001	Dae Gyu Park	29936/37830	3974

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EXAMINER	
CHEN, JACK S J	
ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 11/06/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.	Applicant(s)
10/036,156	Park et al.
Examiner	**Art Unit**
Jack Chen	2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Aug 29, 2002*.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above, claim(s) *5-10* is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-4 and 11-14* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on *Dec 26, 2001* is/are a) ☐ accepted or b) ☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☒ All b) ☐ Some* c) ☐ None of:

1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 2
4) ☐ Interview Summary (PTO-413) Paper No(s). _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

1. In response to the communications dated December 26, 2001 through August 29, 2002, claims 1-14 are active in this application.

2. Claims 5-10 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected species, there being no allowable generic or linking claim. Applicant timely traversed the species restriction requirement in Paper No. 5.

Applicant's election with traverse of claims 1-4, 11-14 in Paper No. 5 is acknowledged. The traversal is on the ground(s) that the species are readily evaluated in one search without placing undue burden on the Examiner. This is not found persuasive because this proposed processes shows seven different species that would require a diversity field of search. It would require undue burdensome search to examine all (different species) claims. Furthermore, on page 8, line 21 to page 9, line 11 clearly show the different embodiments. The separate inventions defined in the last Office Action are each capable of supporting separate patents within meaning of 35 USC 121.

Furthermore, *should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.*

The requirement is still deemed proper and is therefore made FINAL.

Priority

3. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

4. The information disclosure statement filed December 26, 2001 has been considered.

Oath/Declaration

5. Oath/Declaration filed on December 26, 2001 has been considered.

Drawings

6. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the (Re claim 1) barrier metal film and metal film formed by *atomic layer deposition (ALD) process, a remote plasma chemical vapor deposition process* and (Re claim 12) the *polysilicon* and (Re claim 13) the metal film is deposited by *an atomic layer deposition (ALD) process* must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

7. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

8. The following title is suggested: --method of forming a metal gate in a semiconductor device by using atomic layer deposition process--.

9. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

10. Claims 1-4, 11-14 are objected to because of the following informalities:

Regarding claim 1, line 8, the term "the gate" should change to --a gate--.

Regarding claim 2, line 3, the term "(by" should change to --by-- for formality.

Appropriate correction is required.

Double Patenting

11. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321© may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

12. Claim 1 is provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 09/882,103. Although the conflicting claims are not identical, they are not patentably distinct from each other because both of them are directed to the same process for forming the device.

13. Claim 1 is provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 10/033,509.

Although the conflicting claims are not identical, they are not patentably distinct from each other because both of them are directed to the same process for forming the device.

14. Claim 1 is provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 09/887,511. Although the conflicting claims are not identical, they are not patentably distinct from each other because both of them are directed to the same process for forming the device.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Claim Rejections - 35 USC § 103

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was

made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

16. Claims 1, 3-4, 11, 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cha et al., US 2002/0123189 A1 taken with Zheng et al., U.S./6,429,109 B1 and in view of Kang et al., U.S./6,287,965 B1.

Cha et al. disclose a method of forming a metal gate in a semiconductor device, which comprises providing silicon substrate 11 having one or more device isolation films (inherently shows this step since it is a CMOS) for defining an active region (fig. 1); forming a gate insulating film 14 on the surface of said silicon substrate (fig. 1); sequentially forming a barrier metal film 15/16 and a metal film 17 for a gate on said gate insulating film (fig. 1), wherein deposition of said barrier metal film for the gate is performed by a process selected from a group consisting of an atomic layer deposition (ALD) process, a remote plasma chemical vapor deposition process, and a combination thereof (fig. 1, paragraph [0024]), see figs. 1-7, page 1-7.

Regarding claims 3 and 14, wherein said barrier metal film is TaN (fig. 1, paragraph [0023]).

Regarding claim 4, wherein said ALD process is performed using a compound selected from the group consisting of N2, NH3, ND3 and a mixture thereof, as a material for purging a precursor at a temperature of 300 C under a pressure in the range of 0.05-3 Torr (fig. 1, paragraph [0027]).

Regarding claim 11, wherein said metal film 17 for the gate is W (fig. 1, paragraph [0023]).

However, Cha et al. is silent to the method (thermal oxidization process) of forming the gate insulating film, the shape (trench shape) of the isolation and wherein deposition of said metal film for the gate is performed by a process selected from a group consisting of an atomic layer deposition (ALD) process, a remote plasma chemical vapor deposition process.

Zheng et al. teach a method for forming a semiconductor device, which comprises providing a substrate having one or more device isolation films of a trench shape 12 (shallow trench isolation) for defining an active region (fig. 1); forming a gate insulating film 14 on the surface of the substrate by means of a thermal oxidization process (fig. 1, col. 2, lines 16-22) and forming the metal film 16 (fig. 1, col. 2, lines 35-45) by using atomic layer deposition (ALD) process (Regarding claim 13), see figs. 1-3, col. 1-6. Kang et al. also teach a method for forming a semiconductor device, which comprises forming the metal film (Regarding claim 13) by using atomic layer deposition (ALD) process (abstract section) in order to have excellent thermal and oxidation resistant characteristics and excellent step coverage, see figs. 1A-15 and text in cols. 1-18 for more details.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use shallow trench isolation, thermal oxidization to form the gate insulator and forming the metal film by using ALD process as taught by Zheng et al. in the method

of Cha et al. in order to provide a better planar surface, and excellent thermal and oxidation resistant characteristics and better step coverage.

17. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cha et al., US 2002/0123189 A1 taken with Zheng et al., U.S./6,429,109 B1 and Kang et al., U.S./6,287,965 B1. as applied to claim 1 above, and further in view of Nakajima et al. "Work function controlled metal gate electrode on ultrathin gate insulators".

With respect to claim 2, Cha et al., Zheng et al. and Kang et al. are silent to the thermal oxidization parameters. Nakajima et al. teach a method for forming a semiconductor device, which comprises forming the gate insulator/oxide by using thermal oxidization process, wherein said thermal oxidization process is performed at a temperature of 800 C by means of dry (O2) method (Experimental section).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the thermal oxidization parameters to form the gate insulator as taught by Nakajima et al. in the method of Cha et al., Zheng et al. and Kang in order to maximize the deposition process for forming the gate insulator having excellent isolation properties (better isolation, high quality oxide, etc.).

18. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cha et al., US 2002/0123189 A1 taken with Zheng et al., U.S./6,429,109 B1 and Kang et al., U.S./6,287,965 B1. as applied to claim 1 above, and further in view of Prall et al., U.S./5,341,016.

With respect to claim 12, Cha et al., Zheng et al. and Kang et al. are silent to the metal film for the gate has a stacked film structure of polysilicon, a tungsten nitride film, and a tungsten film. Prall et al. teach a method for forming a semiconductor device comprising a metal film for the gate has a stacked film structure of polysilicon 32, a tungsten nitride film 33, and a tungsten film 34 (fig. 7, col. 4, lines 13-24 and col. 5, lines 1-20).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use metal film for the gate has a stacked film structure of polysilicon, a tungsten nitride film, and a tungsten film as taught by Prall et al. in the method of Cha et al., Zheng et al. and Kang in order to provide an adhesion layer between the polysilicon and the tungsten while retarding diffusion between silicon and tungsten.

Conclusion

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jack Chen whose telephone number is (703) 308-5838. The examiner can normally be reached on Monday-Friday (alternate Monday off) from 8:30 am to 6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (703)308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

Jack Chen

JACK CHEN
PATENT EXAMINER

November 4, 2002